



Approval # Product # 201615-O

Industry Services Division
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Wisconsin Building Product Evaluation

Material

GoliathTech Screw Pile System

Manufacturer

GoliathTech Inc
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Magog, Quebec Can. J1X 5R9

Submitter

GoliathTech of SE WI
N68 W13159 Ranch Rd
Menomonee Falls WI 53051

SCOPE OF EVALUATION

The GoliathTech helical pile foundation systems manufactured by GoliathTech Inc have been evaluated for use as foundation systems for use in 1 and 2-family dwellings in accordance with the Wisconsin Uniform Dwelling Code (UDC) requirements and for use in commercial buildings in accordance with the below cited International Building Code (IBC) requirements of the current Wisconsin commercial building code. This approval is for installation of these anchors per the manufacturer's installation manual to support/resist loads as tested and published with the adjustments as noted below.

DESCRIPTION AND USE

The GoliathTech helical pile foundation system offers a recognized and cost effective alternative to other pile systems. GoliathTech product design was reviewed by various agencies in order to confirm the multiple regulations. These unit designs are covered by U.S. Design Patent Nos.

D735,569 & D735,896 and in 2015 were evaluated (Evaluation Report CCMC 13675-R) through the Canadian Construction Materials Centre (CCMC), a program of the National Research Council of Canada to provide the technical requirements and performance criteria for evaluating helical steel piles. The scope of that evaluation was restricted to the foundation system (steel piles and connectors).

GoliathTech in house engineering team reviews hundreds of projects to determine the appropriate pile design and configuration in order to meet various laws and standards. When required, local firms are contacted in order to validate the proposed designs and assure system compliance.

GoliathTech offers round shaft helical piles as stocked items. As detailed in the company's product table, the company offers 14 round shaft helical piles ranging in diameters from 1.875 inches to 12.75 inches. They also offer a variety of pile caps available for different applications of the product, including adjustable height either flat tops and U-shaped tops.

GoliathTech Helical Pile number	Size	Ultimate Capacity based on torque (KIPS - kN) ¹	Helix Bearing Plate grade & thickness	Section Coupling Method
GTPI178	O.D. = 1.875 in Wall = 0.154 in	Comp = 19 kips – 85 kN Ten = 19 kips – 85 kN	CSA G40.20-13/G40.21-13 0.38 in std	0.50 in Galvanized Grade 5 Bolts
GTPI238	O.D. = 2.375 in Wall = 0.154 in	Comp = 32 kips – 144 kN Ten = 32 kips – 144 kN	CSA G40.20-13/G40.21-13 0.38 in std	0.50 in Galvanized Grade 5 Bolts
GTPI278	O.D. = 2.875 in Wall = 0.25 in	Comp = 64 kips – 288 kN Ten = 64 kips – 288 kN	CSA G40.20-13/G40.21-13 0.38 in std 0.50 in opt	0.50 in Galvanized Grade 5 Bolts
GTPI312	O.D. = 3.50 in Wall = 0.25 in	Comp = 77 kips – 348 kN Ten = 77 kips – 348 kN	CSA G40.20-13/G40.21-13 0.38 in std 0.50 in opt	0.50 in Galvanized Grade 5 Bolts
GTPI412	O.D. = 4.50 in Wall = 0.25 in	Comp = 115 kips – 517 kN Ten = 115 kips – 517 kN	CSA G40.20-13/G40.21-13 0.38 in std 0.50 in opt	0.50 in Galvanized Grade 5 Bolts
GTPI5916	O.D. = 5.563 in Wall = 0.375 in	Comp = 212 kips – 953 kN Ten = 212 kips – 953 kN	CSA G40.20-13/G40.21-13 0.38 in std 0.50 in opt	0.75 in Galvanized Grade 5 Bolts
GTPI658	O.D. = 6.625 in Wall = 0.25 in	Comp = 176 kips – 789 kN Ten = 176 kips – 789 kN	CSA G40.20-13/G40.21-13 0.38 in std 0.50 in opt	0.75 in Galvanized Grade 5 Bolts
GTPI658X	O.D. = 6.625 in Wall = 0.375 in	Comp = 249 kips – 1118 kN Ten = 249 kips – 1118 kN	CSA G40.20-13/G40.21-13 0.38 in std 0.50 in opt	0.75 in Galvanized Grade 5 Bolts
GTPI858	O.D. = 8.625 in Wall = 0.25 in	Comp = 229 kips – 1030 kN Ten = 229 kips – 1030 kN	CSA G40.20-13/G40.21-13 0.38 in std 0.50 in opt	0.75 in Galvanized Grade 5 Bolts
GTPI858X	O.D. = 8.625 in Wall = 0.375 in	Comp = 329 kips – 1479 kN Ten = 329 kips – 1479 kN	CSA G40.20-13/G40.21-13 0.38 in std 0.50 in opt	0.75 in Galvanized Grade 5 Bolts
GTPI1034	O.D. = 10.75 in Wall = 0.25 in	Comp = 242 kips – 1085 kN Ten = 242 kips – 1085 kN	CSA G40.20-13/G40.21-13 0.38 in std 0.50 in opt	1.00 in Galvanized Grade 5 Bolts
GTPI1034X	O.D. = 10.75 in Wall = 0.375 in	Comp = 350 kips – 1572 kN Ten = 350 kips – 1572 kN	CSA G40.20-13/G40.21-13 0.38 in std 0.50 in opt	1.00 in Galvanized Grade 5 Bolts
GTPI1234	O.D. = 12.75 in Wall = 0.25 in	Comp = 344 kips – 1544 kN Ten = 344 kips – 1544 kN	CSA G40.20-13/G40.21-13 0.38 in std 0.50 in opt	1.00 in Galvanized Grade 5 Bolts
GTPI1234X	O.D. = 12.75 in Wall = 0.375 in	Comp = 501 kips – 2248 kN Ten = 501 kips – 2248 kN	CSA G40.20-13/G40.21-13 0.38 in std 0.50 in opt	1.00 in Galvanized Grade 5 Bolts

Above Table footnote states that the Ultimate Capacity values shown only address correlated soil capacity. Other mechanical limits states of the pile/anchor, its couplers, and its connections to the structure (brackets) may also govern the design capacity. Large diameter helical piles develop capacity by a combination of both end-bearing and skin friction. The ultimate pile capacity is calculated based on the site-specific soil profile on a case-by-case basis. Safety factors must be added to the above numbers according to local laws and regulations where the product is being installed.

The output of the above referenced evaluation report led to various publications and to the standardizing of training documents & processes. GoliathTech has recently uploaded the KT system calculations into their charts, reflecting the most common engineering analysis method in the US territory.

- Pile selection chart: outlining the capacities generated by the torque applied on the piles (KT system).
- Installation Manual: is to detail the equipment, labor and installation techniques necessary to install Helical Piles as specified on the drawings and the connection details.

The installation of the helical pile must be carried out as per the manufacturer's current instructions. The anchors must be screwed into the ground to below the frost line using mechanized equipment. The anchor is rotated into the ground with sufficient applied downward pressure (crowd) to advance the anchor one pitch distance per revolution. The anchor is advanced until the applied torque value attains a specified value. Extensions are added to the central shaft as needed. The applied final loads may be tensile (uplift), compressive (bearing), shear (lateral), or a combination thereof. Helical anchors may be rapidly installed into a wide variety of soil types and formations using a variety of readily available equipment. They are immediately ready for loading after installation.

Use limits are as follows:

- When the product is installed in a soil where the conditions are corrosive to steel, adequate protection to the exposed steel must be provided. Product is hot-dipped galvanized steel.
- The installer of the proposed helical piles must be certified by GoliathTech Inc. Using approved equipment, the installer must follow the manufacturer's current installation instructions and the uses and limitations specified in the Installation Manual. Each installer shall carry a certification card bearing their signature and photograph.
- Each helical pile must be identified with a label containing the following information:
 - manufacturer's identification; and
 - the phrase "CCMC 13675-R."
- The product may be used as part of a foundation system to support various constructions, provided that it is installed according to the manufacturer's current instructions and within the scope of the CCMC Report.
- When the product is installed in granular soil or silt, there is a direct relationship between the applied torque and the allowable compressive and tensile loads. Table 1 (below) indicates the allowable compressive and tensile loads as a function of the applied torque.
- When the helical pile is installed in a cohesive soil, such as clay or a soil with granular material that exceeds 200 mm in diameter, the relationship between the applied torque and the allowable compressive and tensile loads is not as predictable.

- When it is installed in cohesive soil, such as clay, the allowable compressive and tensile loads have to be confirmed by the on-site GoliathTech load test procedure of recording the hydraulic pressure and /or torque readings at the final depth during installation. Those will then be compared to the GoliathTech pile selection chart, which is based on the recognized KT system.
- Other load tests could be required if there were any boulder (> 200 mm or 8¹/₈" in diameter) encountered in the granular matrix or if the allowable loads need to be greater than those stated in Table 1 (below). Such tests need to be conducted under the direct supervision of a professional geotechnical engineer, skilled in such design and licensed to practice in Wisconsin.
- In all soil cases not described above, a registered Wisconsin professional engineer skilled in such design must determine the number and spacing of the auger-installed steel piles required to carry the load. A certificate attesting to the conformity of the installation and the allowable loads for the piles must be provided at the job site at completion.

Table 1 Allowable Compressive and Tensile Loads for the Proposed Helical Pile in Granular Soil or Silt¹

Applied Torque		Allowable Loads			
		Compression		Tension	
Nm	(lbf)	kN	(lb)	kN	(lb)
678	500	20	4500	12	2700
1017	750	23	5175	15	3375
1356	1000	27	6075	18	4050
1695	1250	30	6750	20	4500
2034	1500	33	7425	23	5175
2373	1750	37	8325	26	5850
2712	2000	40	9000	29	6525
3051	2250	44	9900	32	7200
3390	2500	47	10575	34	7650
3728	2750	51	11475	37	8325
4067	3000	54	12150	40	9000
4406	3275	57	12825	42	9450
4745	3500	61	13725	45	10125
5084	3750	64	14400	48	10800
5423	4000	68	15300	51	11475
5762	4250	71	15975	54	12150
6101	4500	74	16650	57	12825
6440	4750	78	17550	59	13275
6779	5000	81	18225	62	13950
7457	5500	88	19800	67	15075
8135	6000	95	21375	72	16200

Note to Table 1: The allowable loads identified in this table are only valid when the product is installed in granular soil or silt. The applied torque is the average of the values attained within the last 600 mm of installation. Special attention is required when the auger-installed steel piles are installed in a recently backfilled site or where the granular material exceeds 200 mm in diameter or in cohesive soils. In these cases, Table 1 does not apply and the allowable loads need to be determined by on-site confirmatory testing.

TECHNICAL TESTING USED

The proposed helical piles were tested to ASTM D 1143/D 1143M-07(2013), "Standard Test Methods for Deep Foundations Under Static Axial Compressive Load," ASTM D 3689/D 3689M-07(2013)e1, "Standard Test Methods for Deep Foundations Under Static Axial Tensile Load," and ASTM D 3966/D 3966M-07(2013)e1, "Standard Test Methods for Deep Foundations Under Lateral Load."

Testing was conducted on a site with granular soil. A series of 32 tests were performed. The intent of the testing was to determine a correlation between the torque applied during installation and the allowable loads. In the granular and silt-based soil there was a good correlation between the torque applied during installation and the allowable loads. For the compressive loads noted in Table 1 (above), the factor of safety varied from 2.0 to 3.0. For the tensile loads, the factor of safety varied from 2.0 to 2.7. For the lateral loads, no correlation was possible. For a cohesive soil, such as clay, the correlation between the applied torque and the allowable loads was not as predictable.

LIMITATIONS OF APPROVAL

The 2009 **IBC** limitations below are in accordance with the current **Wisconsin Amended ICC Code**: IBC 1809.4 requires minimum 12" footing width, thus minimum 13" diameter helix must be used on all commercial building footing systems installed in Wisconsin. Footings shall be installed with bottom helix below frost depth.

The UDC limitations below are in accordance with the current **Wisconsin Uniform Dwelling Code**: GoliathTech helical pile foundation installed in accordance with current manufacturer's installation instructions is granted an exception to the SPS 321.15(2)(b)1. minimum pier footing size of 2' x 2' when load test data is provided to the local building inspector upon completion of the pier footing installation.

DISCLAIMER

This approval will be valid through December 31, 2021, unless manufacturing modifications are made to the product or a re-examination is deemed necessary by the department. The Wisconsin Building Product Evaluation Number must be provided when plans that include this product are submitted for review. This approval addresses only the specified applications for the product and does not waive any code requirement not specified in this document.

Reviewed by: Jack A. Miller
Commercial building plan examiner

Approval Date: November 17, 2016 By: Jack A. Miller